Coastal Integrated Throughput Model

Debra R. Green

Computer Specialist

US Army ERDC

Coastal & Hydraulics Laboratory

Features of CITM

- *FORTRAN Code*

- *PC Based*

- *Cumulative/recent throughput output*

- *Includes various environmental data*

- *Models all current watercraft and off-load nodes*

- *Various Time-time intervals*

$$c_i = \text{Base Time} * F_{exp} * F_{tod} * F_{ss} * F_{comp} + \text{Queue Time}$$

$$c_{total} = \sum_{i=1}^{4} c_i + c_{maint} + c_{fuel}$$

"Force Projection is a system of systems"

- Very complex

- Very nonlinear

  - must account for bottlenecks/problems

- Extremely affected by environmental conditions

  - sea state varies day-to-day and year-to-year

  - tides and nearshore bars

  - must connect to inland throughput capabilities

- Only an objective time-domain tool can provide accurate answers

CITM provides correct framework for this tool

PURPOSE

Tool to evaluate force projection capabilities when deep-draft ports are unavailable

- ◆ **Conventional JLOTS**
    - ✦ **Lift-On/Lift-Off**
    - ✦ **Roll-On/Roll-Off**
- ◆ **Emerging technologies**
    - ✦ **Theater Support Vessel (TSV)**
    - ✦ **Enhanced small ports**
- ◆ **Identification of limiting factors to throughput**
- ◆ **Objective site selection**
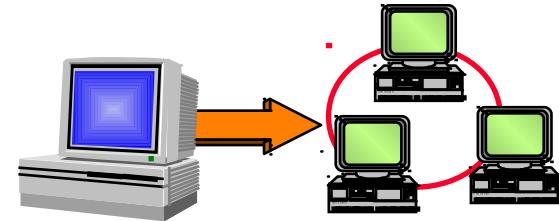
CITM Version 2

- Includes effect of nearshore bars on bare beach discharge

- Includes effect of tides

CITM Version 3

- Will include beach clearance/beach preparation module

- Will include random effects

- Will provide capability to integrate conventional JLOTS throughput and TSV throughput via existing unimproved and enhanced small ports

RECENT CITM IMPROVEMENTS

NEARSHORE BATHYMETRY COMPONENT
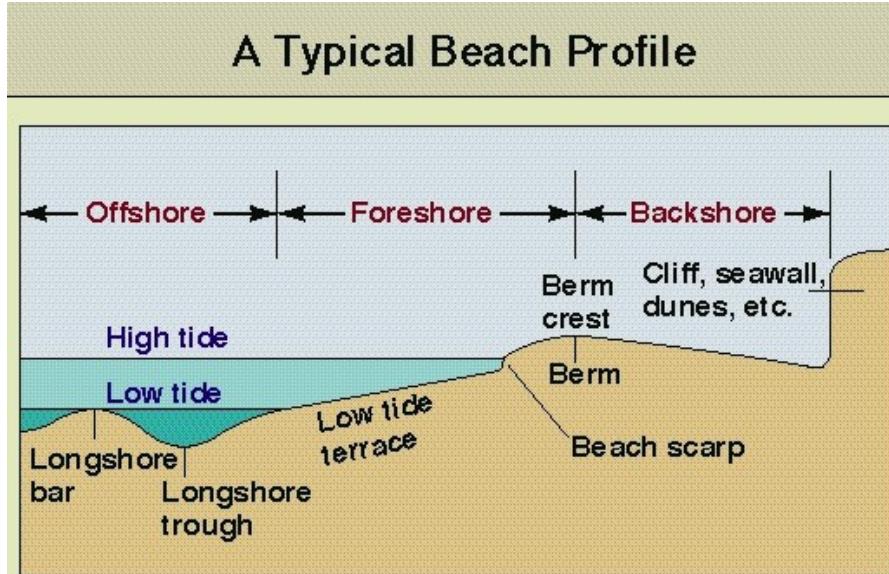
A Typical Beach Profile

CROSS-BEACH COMPONENT
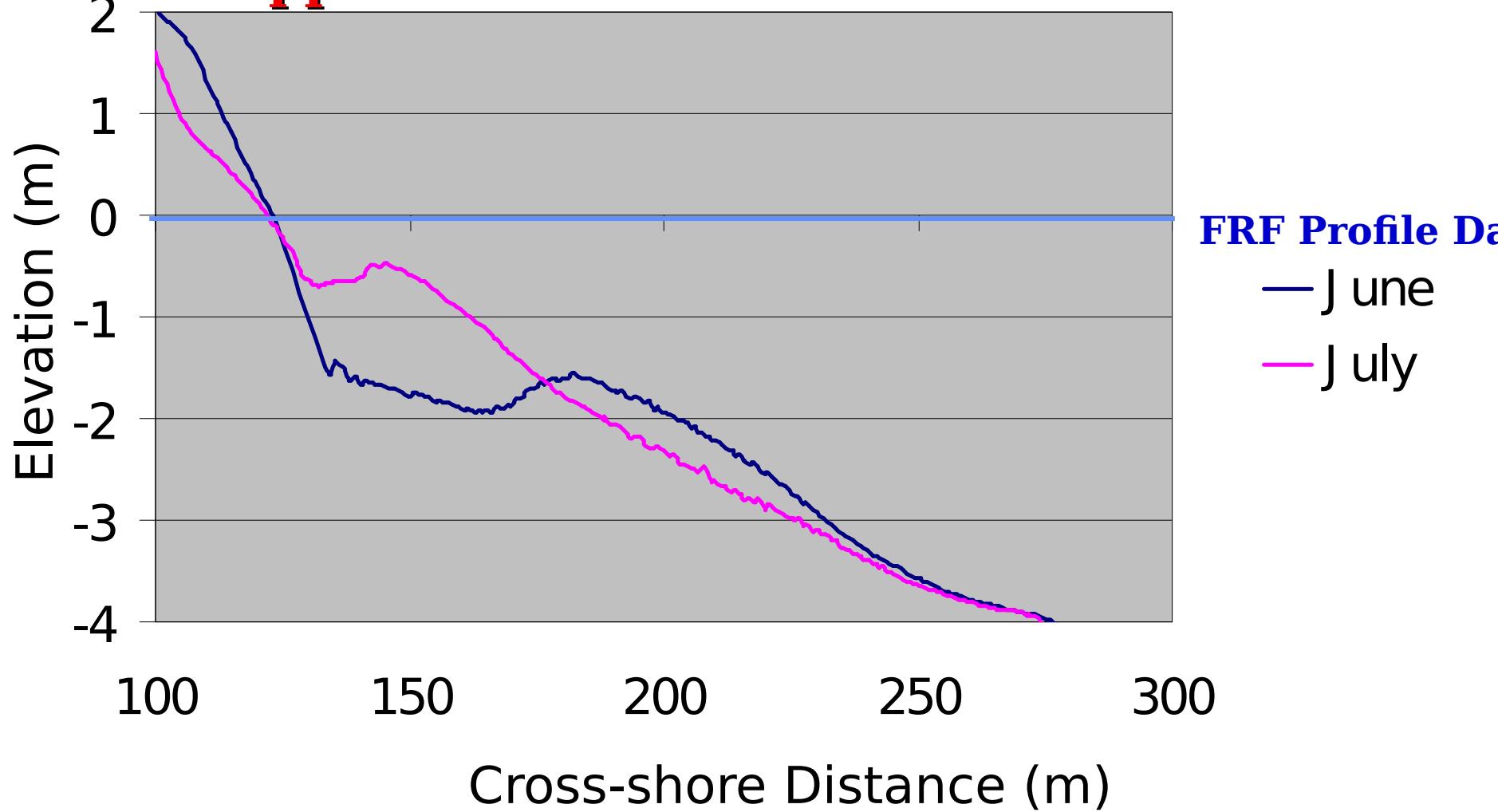
Effect of Tide and Bathymetry on Lighter Bare Beach Approach

Effect of Tide and Bathymetry on Lighter Bare Beach Approach

Cross-shore Distance (m)
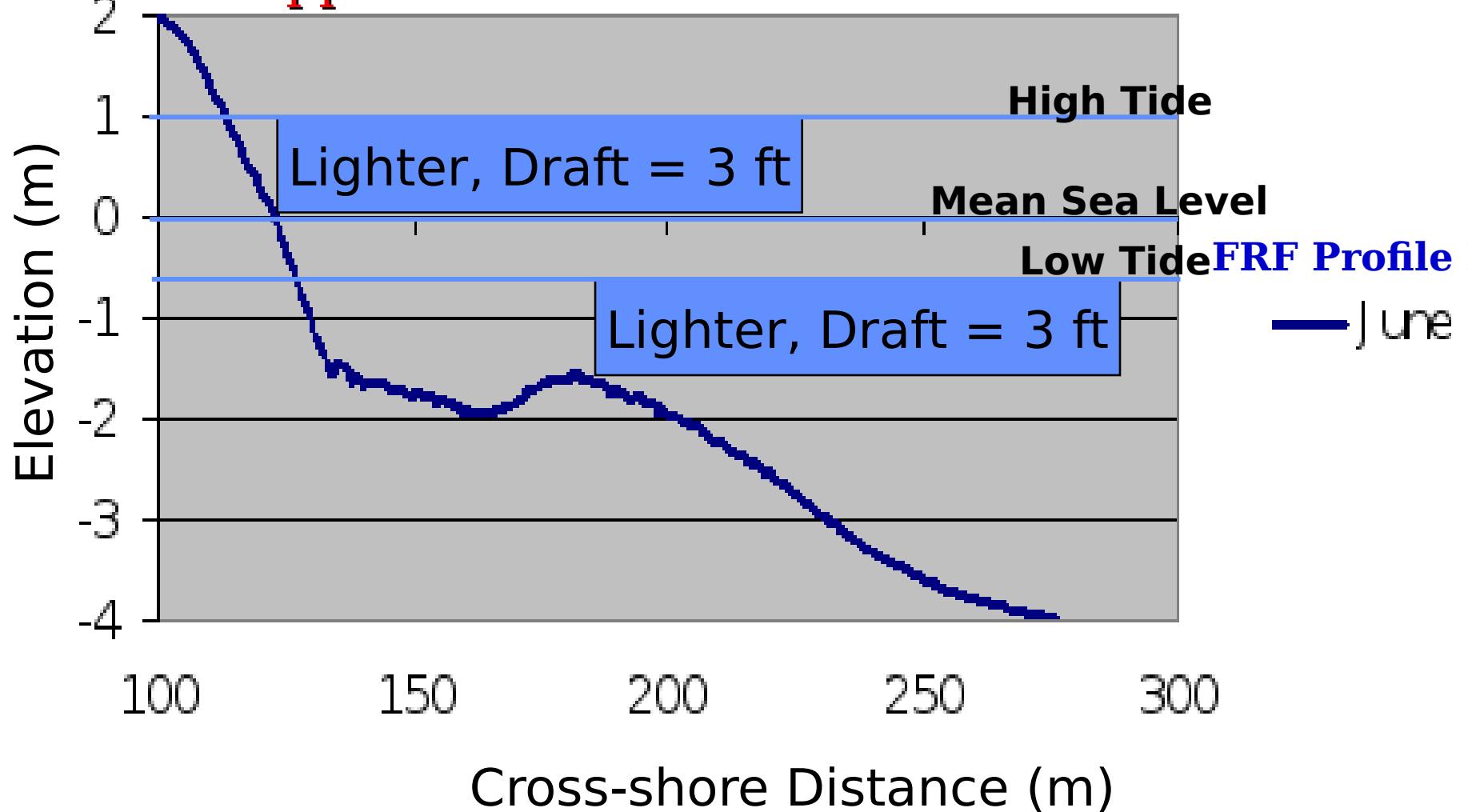
Effect of Tide and Nearshore Bars on Thr

- Water Surface Elevation (m NGVD)
- Time (hrs)
- = Time Available for Bare Beach Access
- Min. Depth for successful CSP Bar Clearance
- Bar Crest
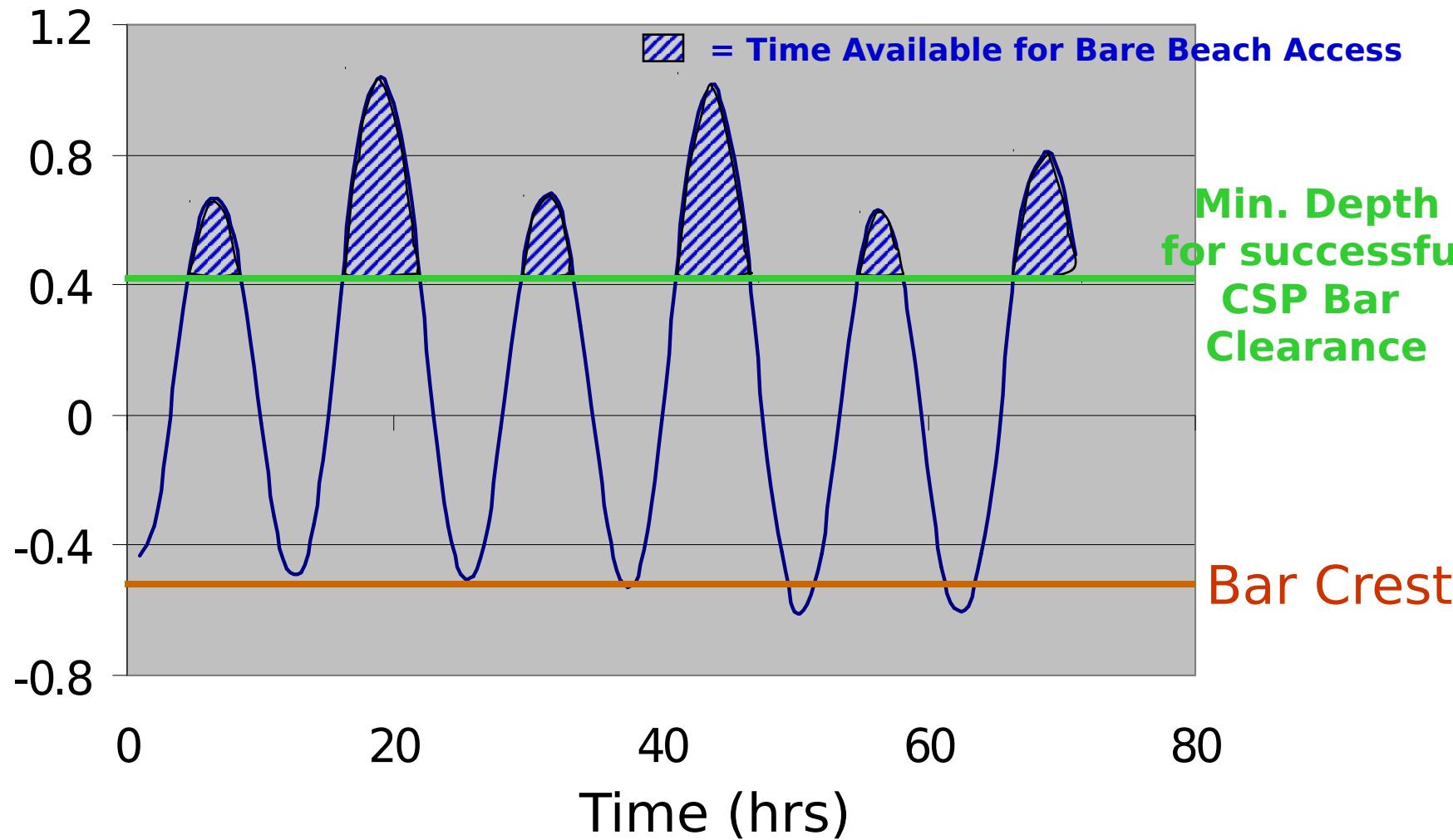
Beach Clearance Module
Sample of Plotted Output from Beach Clearance

Cumulative Number of 20 ft. Containers Moved
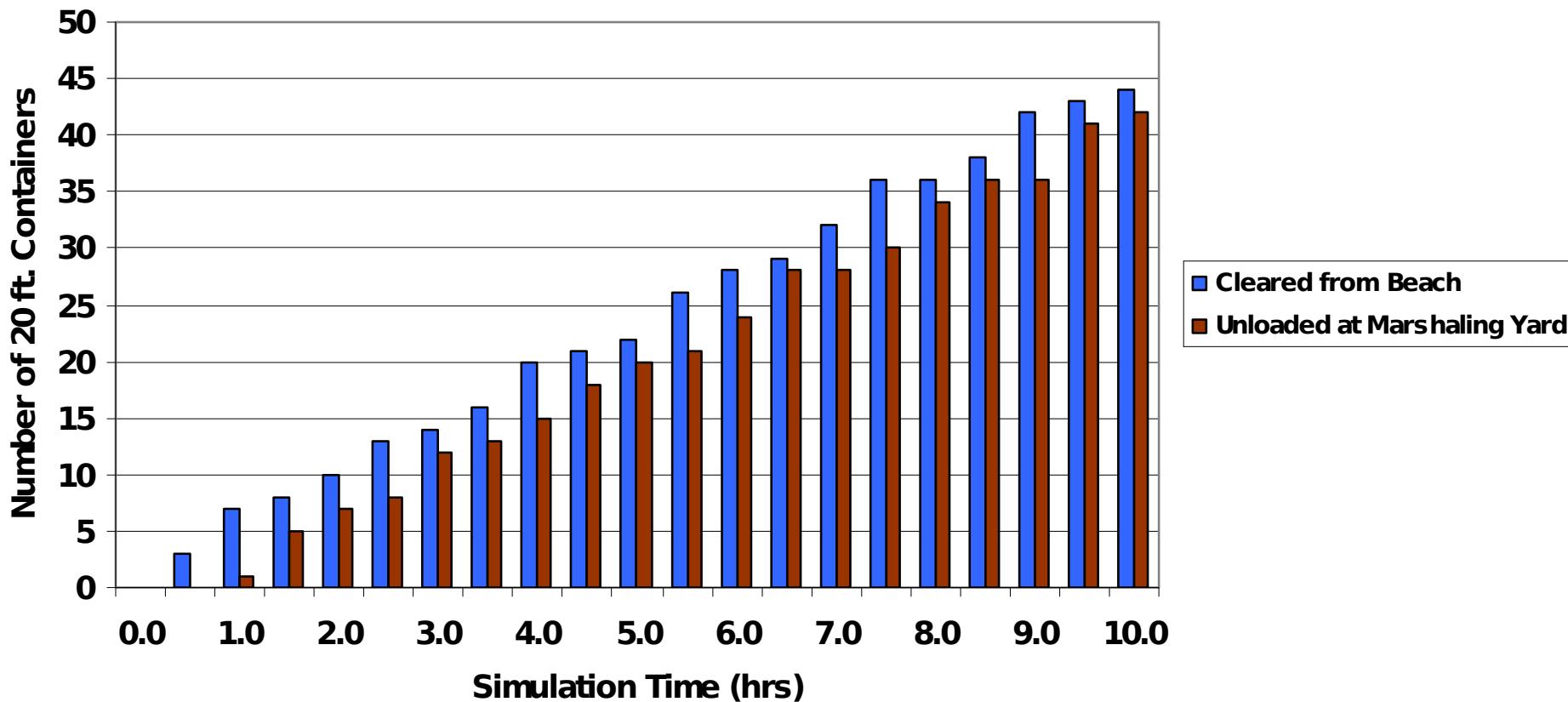
Sample of Output from Beach Clearance Modu

```
**************************************************
**   CURRENT SIMULATION TIME:  155.0 Minutes  **
**************************************************


Vehicle ID (Name):    9 (M1070/M1000/20FT)    Assigned To Site:  3
Vehicle Speed:      0.00
Current Vehicle State: UNLOADING AT MARSHALING YARD Marshal01  IN Area-A


                                           X       Y
                                        ------ ------
Current Location:                         2.00   2.00
Location Heading Toward:                  2.00   2.00
Site/Marshaling Yard Location Heading To:  2.00   2.00
Surface Type Vehicle Is On: ASPHALT
                    20-ft containers     40-ft containers      RO/RO
                    ----------------     ----------------      -----
Site Load:               294                  199                10
Vehicle Load:              2                    0
Marshaling Yard Load:      9                    3
Marshaling Yard Vehicle Capacity:       1
Vehicle ID (Name) in MY Waiting Queue:
Current Vehicle at Site Load Time:       0.0
```

CITM Support to War Planners

- Real World:
  - Balkan theater of operations throughput analysis

- War-fighter Exercises:
  - Ulchi Focus Lens (UFL) 2001
    - Throughput analysis
    - JLOTS site evaluations
    - East coast Korea
  - RSO&I 2001
    - Throughput analysis
    - JLOTS site evaluations
    - East and West coast Korea

- US Army Engineer Research & Development Center (ERDC) Tele-Engineering Operations Center (TEOC)
  - integration of CITM into the Tele-Engineering Toolkit
  - addition of module for user-defined lighters

- JLOTS Computer Based Training (Navy JLOTS training course)
 - inclusion of CITM as a training tool for students

TEOC Toolkit

- Designed to facilitate communications between subject matter experts and persons submitting requests for information/analysis

- Uses NIMA-produced data

- Displays topographic maps, imagery, and terrain data for exploitation for engineer applications

Imagery
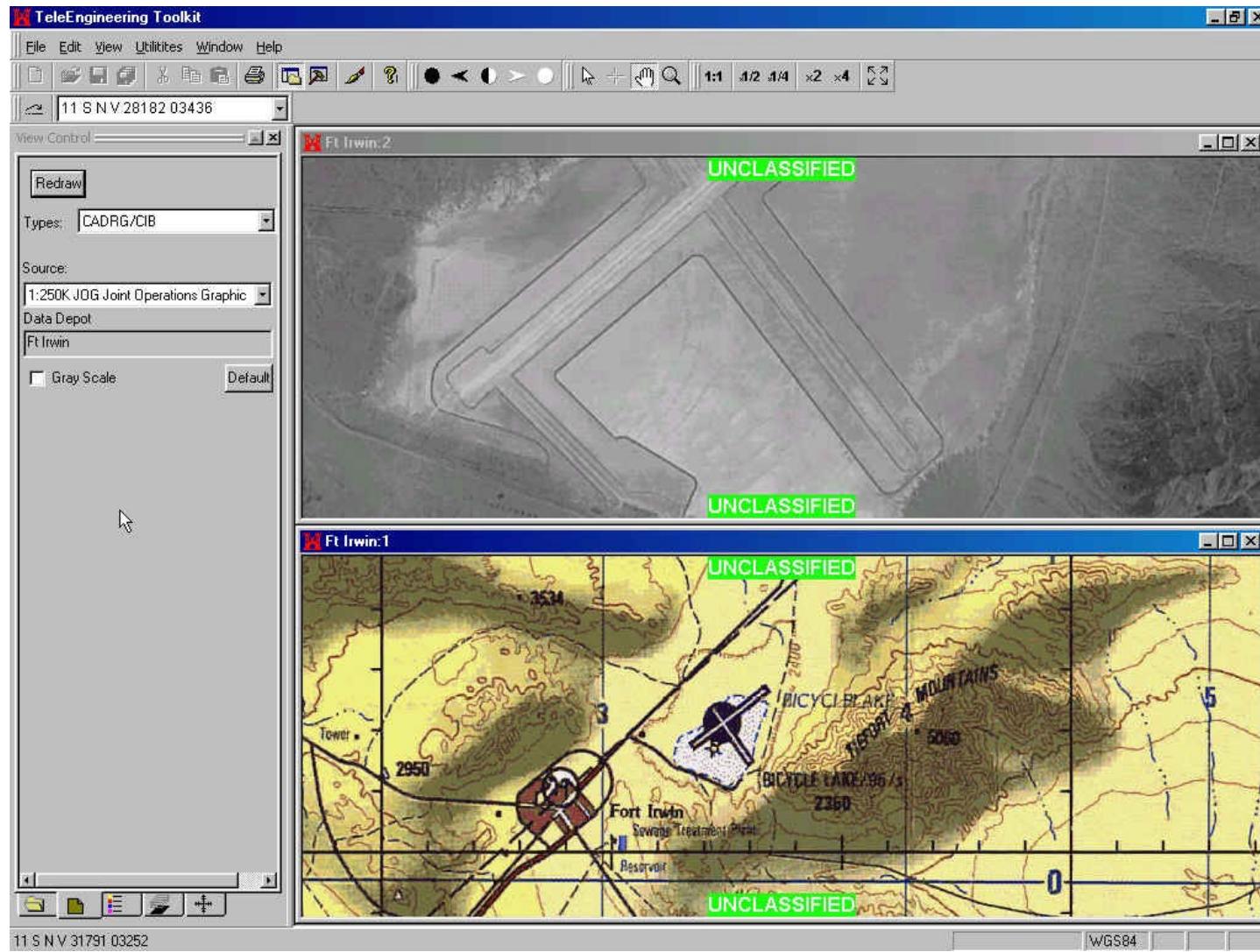
JLOTS Site Selection
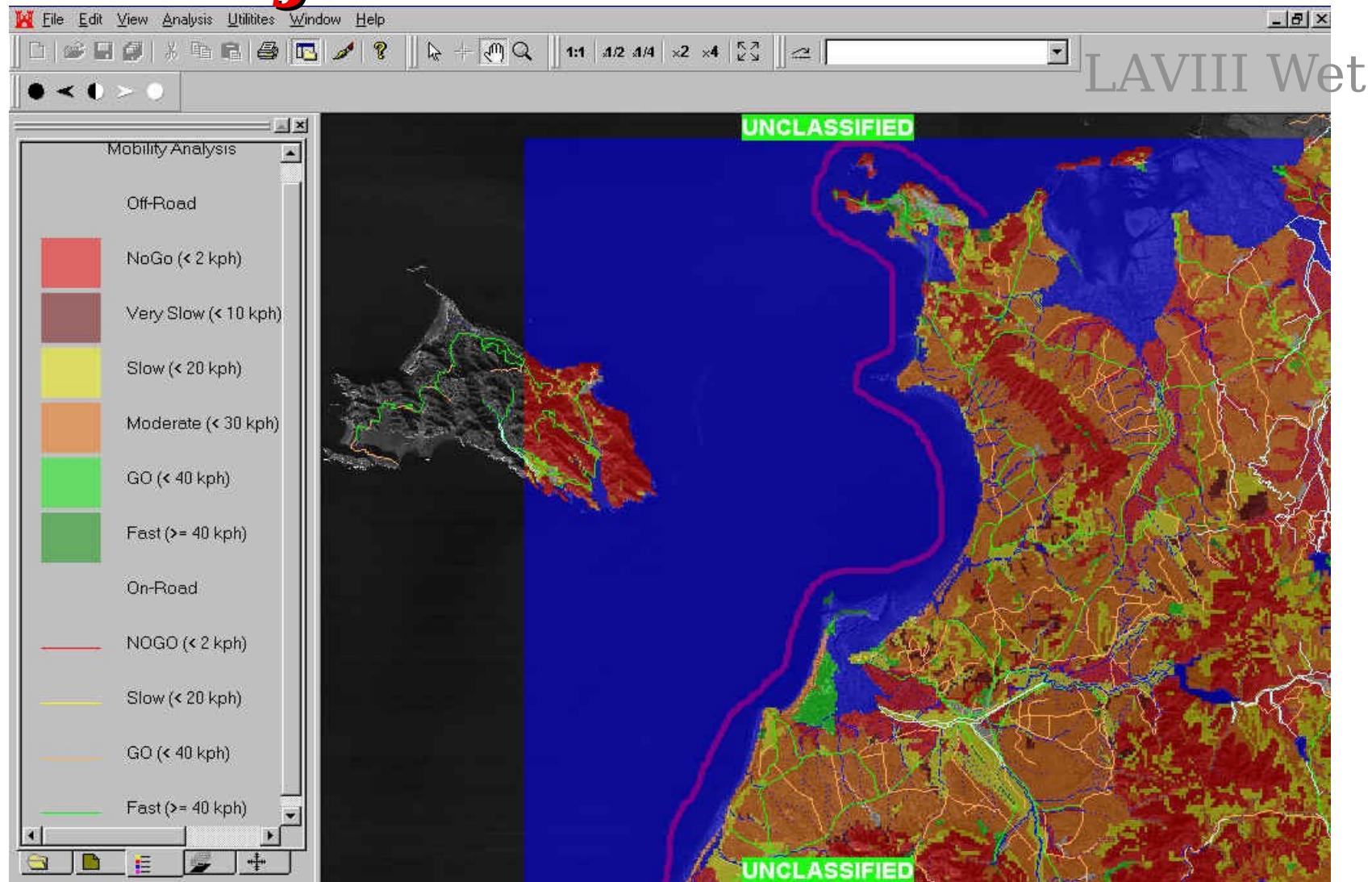
JLOTS Analysis
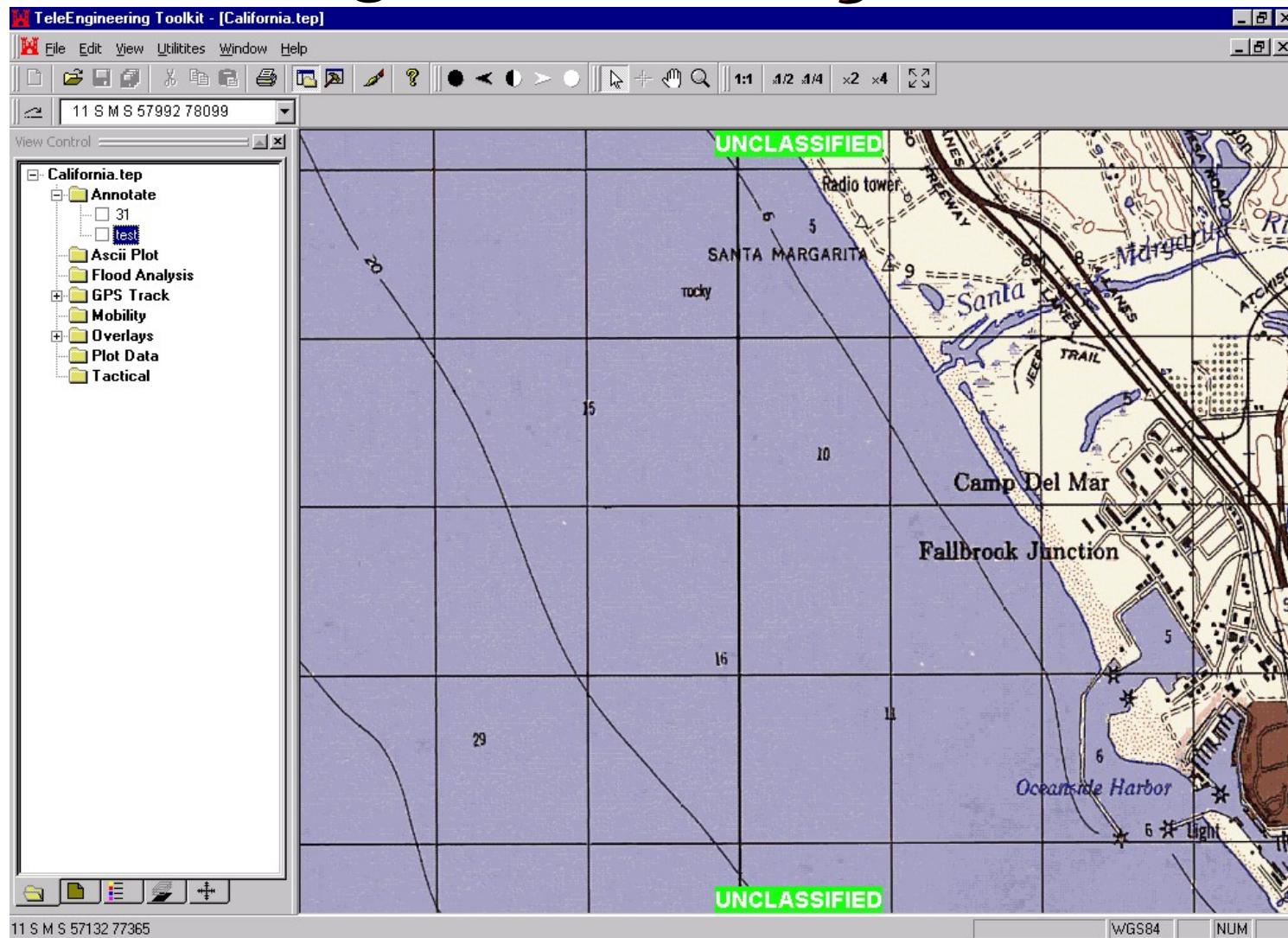
JLOTS Computer Based Training

- Include stand-alone version of CITM
- Objective is to create a tool for students to use to create a JLOTS resourcing and scheduling plan
  - Graphical User Interface (GUI) for input allowing the student to drag and drop and point and click (Currently under development)
  - Generic coastlines to include environmental characteristics of varying sea-states, tides, currents and beach gradients
  - OPDS Deployment and fuel delivery
  - Generate presentation-style output graphs

Example of GUI Screen
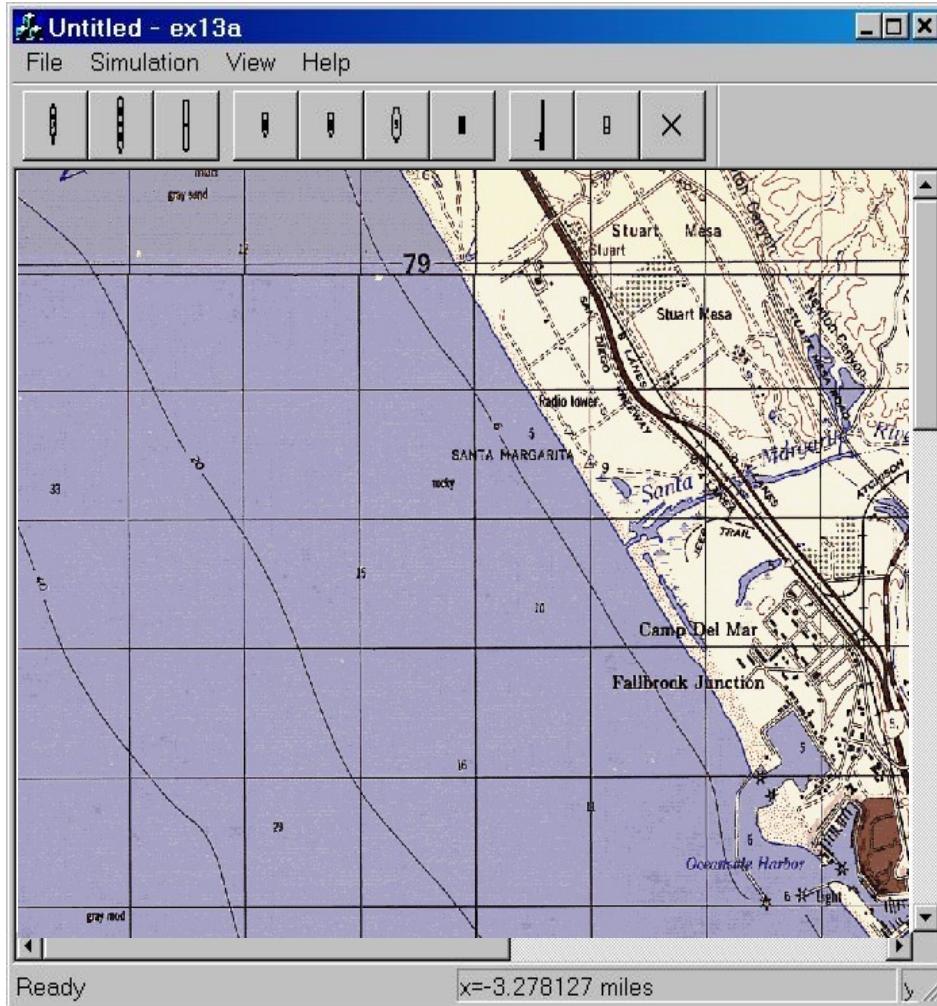
- Icon Toolbar for ships, lighters and discharge sites

- Drag and Drop capability for placement of icons

- Distance from shore

Summary

- CITM is a constructive simulation tool for objective estimates of throughput potential around the globe

- Used in support of War-fighter Exercises

- Throughput prediction for different nodes
  - Bare Beach
  - Existing Small Ports (unimproved)
  - Enhanced Small Ports

QUESTION(S)?